OUTLIER DETECTION, SEASONAL ADJUSTMENT AND CYCLE EXTRACTION IN NEW MEMBER STATES OF EUROPEAN UNION

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Abstract:
An econometric exercise is run to identify outliers, seasonal adjust and extract the cycle from New Member States GDPs series. Obtained results are showed with full statistics. For the NMS aggregate direct vs. indirect approach is compared.

JEL classification: C32
Keywords: Seasonal adjustment, outlier detection and Demetra

1. Introduction

In this paper is adopted the classification which refers to the state of the art of the enlargement process at the 1st of May 2004. New Member States (NMS) are: Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovenia and Slovakia. This paper concentrates the analysis in particular on the issues of the outliers detection, the Seasonal Adjustment (SA) policy and the Business Cycle (BC) analysis. The work is structured as follow. Section 2 gives an overview of the NMS showing theirs main figures. Section 3 describes the main strategies adopted when carrying out the SA policy. Section 4 includes the exercise with the seasonal adjustment of the GDPs at constant prices. Section 5 includes the case studies with cycle extraction for the GDPs. Section 6 resumes the main conclusions achieved by the paper and suggests future research lines.

2. Overview on New Member States

With the accession of ten New Member States on 1st May 2004, the European Union has taken the most important enlargement in its

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history. EU has extended its membership from 15 to 25 countries, bringing in the Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia as new members. This enlargement, the fifth to take place since the beginning of the European Community 50 years ago, demonstrates once again the attraction of the European model for young democracies. Yet this enlargement is unlike those that preceded it. Never before have so many accessions taken place at the same time. Never before have they been so thoroughly prepared, with a sweeping transformation of the economies and societies of the applicant countries. Stable democracies and functioning market economies are now well established in Central and Eastern Europe, and the credit for this success lies mainly with the governments and people of those countries, aided by the prospect of EU membership. In a historical perspective, the coming enlargement is more than another extension of the EU: it represents the application on a continental scale of a European model of peaceful and voluntary integration among free peoples.

In fact, it is the realisation of a dream of the founders of European integration: the reunification of the European continent, divided in the aftermath of the Second World War. The NMS need also to adjust to their future role as members of the EU, with full and equal rights. Up to now, their work on the way to Europe has been to adopt and implement the common policies: their new work in Europe, beginning with accession, will be to exercise a voice in the making of those policies. The EU institutions and member states, too, must prepare themselves for expansion, by finalising the Constitutional Treaty to give an adequate framework for the operation of the enlarged Union. The process of enlargement is a challenge that the EU has willingly accepted. The existing members consent to share with others the benefits obtained in Western Europe through the creation of a political and economic area where war has become impossible.

The prospective members look to us for guarantees of stability, peace and prosperity, and for the opportunity to share with us in the unification of Europe. For their new democracies, Europe is a powerful symbol, signifying their fundamental values and aspirations. The Union's population has risen from 381 million to 455 million, which means that the population of the ten new members combined will has a share of 16% in the whole of the enlarged European Union (EU-25 from 1 May 2004 onwards). With an area of 73.9 million km^2 the NMS amount to 19% of the area of the EU-25. In contrast, the Gross Domestic Product (GDP) of the NMS represents a mere 5% of the EU-25 GDP. Per capita, GDP in the NMS –expressed in Purchasing Power Standards (PPS) – is less than 50% of the value of the current European Union (EU-15). The largest country among the new Member States, in terms of area, population and GDP, is Poland, well ahead of Hungary and the Czech Republic. For GDP per capita, Cyprus, Slovenia and Malta show the highest while the Baltic countries and Poland show the lowest.

Table 1 Main Indicators NMS Year 2002

	AREA	Population		GDP in PPS				Share Agr	
	1000 km²	Mill.	Inhab. / km²	Billion €	p.c. in €	% EU p.c.	rt	% GVA	% employ.
CY	9	0.8	86	14	17400	72	2.2	4.3	5.3
CZ	79	10.2	130	146.9	14400	60	2	3.7	4.9
EE	45	1.4	30	13.5	10000	42	6	5.4	6.5
HU	93	10.2	108	138.2	13600	57	3.3	4.3	6
LV	65	2.4	36	19.9	8500	35	6.1	4.7	15.3
LT	65	3.5	53	34.3	9400	39	6.7	7.1	18.6
MT	0.3	0.4	1259	4.6	11700	55	1.2	2.8	2.3
PL	313	38.2	122	363	9500	39	1.6	3.1	19.6
SK	49	5.4	110	61.3	11400	47	4.4	4.5	6.6
SL	20	2	99	35.3	17700	74	3.2	3.3	9.7
EU15	3234	378.4	117	9166.5	24010				
NMS	739	74.3	100.5	831.0	11150				
EU25	3973	452.7	113.9	9997.5	21910				

Note: rt=rate of growth of GDP.

3. Strategies for outliers detection and seasonal adjustment policy

The scheme for the statistical analysis focuses on the variables quarterly GDPs at constant prices of the ten NMS. The respective aggregated GDPs are used when comparing the direct vs. indirect approach. The aim of this study is to take initial steps in investigating the time series properties of quarterly GDP in NMS for the analysis of the economic situation by analyst, economist and policy decision makers. To investigate the behaviour of GDP series, both econometric and statistical tools are available. In this study, X-12 ARIMA, and in some few cases Tramo Seats is used to decompose the series trough the DEMETRA interface. Since the quantity of information is not easy to handle, default options will be used within the Demetra *automatic mode*.

For those series where difficulties are found, we will make use of the Demetra *detailed mode*. Where relevant, evidence of different parameterization from the default is given. In general, this study takes only a few initial steps in investigating the seasonality of the data, and should not be taken to represent definitive adjustments. Results could be improved by discussion exchange of information with the expert from the respective countries. In the entire paper, no testing is performed on new approach or methodologies in the field of seasonal adjustment.

Main reference for the policy to adopt is be the final report delivered (January 2002) by the Eurostat/ECB task-force on Seasonal Adjustment of QNAs. The strategy has three main steps: 1) Look at the raw data to get a general feeling for the series and to identify whether or not it contains seasonality, changes in seasonal pattern, differences/changes in amplitude, seasonal breaks, outliers. 2)Adjust using X-12 ARIMA default options, as follow: a)Test on working days by one regressor; b) The sum of the seasonally adjusted quarters will be equal to the annual raw figures; c) A pre-test for working day correction, log transformation and for the presence of a six-day Easter effect is compiled; d)The critical value of the detection of outliers is calculated automatically. 3)Make prior adjustments and user-defined options where necessary to improve the adjustment. The selection of the model will be mainly made looking at: M-statistics, ARIMA coefficients, Standard error, Forecast error.

4. Case studies: outliers detection and seasonal adjustment of NMS and CCS GDPs at constant price

The following statistical analysis is carried out according the strategy indicated in the paragraph above. The graphs are produces by the Demetra interface. The input data set has been provided by the New Cronos database, where the extraction was done on the 19th of April 2004. The statistical tests are provided according the standard Demetra output file.

4.1. Cyprus. Cypriot GDP represented about 3.1 % of NMS GDP in 2002. *Seasonal pattern* – The pattern in all years shows increases Q1-Q2 and decreases Q3-Q4 and Q4-Q1. Q2-Q3 shows decreases for the years 1995, 1996, 1999 and 2000 and increases for the rest. *Amplitude* – The amplitude of the seasonality does not have big changes all over the period under analysis. The pre-testing identified the logarithmic transformation to be relevant. *Trend* – The series has a clearly upward trend all along the period. *Outliers* – The series does not seem to have any outliers. After an initial graphical appreciation of the series, X-12 ARIMA default is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The ARIMA model (0 1 2) (0 1 1) has been automatically selected. Q2 1997 has been identified as additive outlier. The results of the seasonal adjustment are good and the final message from Demetra is: “Model passes all diagnostic tests”. Some critics to the default results: a) the series could be over-differenced. The coefficient of MA (lag 2) is -0.49 with t-value out of the range. The coefficient of MA (lag 4) is 0.69 with t-value out of the range. b) trading days correction is performed even if not statistically significant. In the table E5 (quarter-to-quarter percent change in the original series), the percent change of 9.4 for Q2 1997 is low compared to the rest of the percentages of the same quarter. The identification of this value as additive outlier appears to be acceptable.

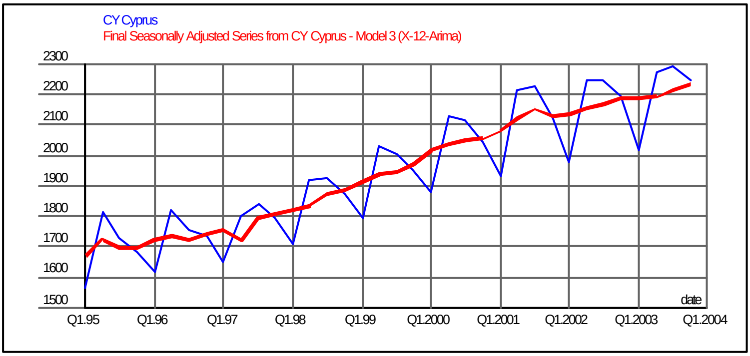
Table 2 Quarter-to-quarter percent change in the original Cypriot series E 5

From 1995.2 to 2003.4 Observations 35

	1st	2nd	3rd	4th	AVGE
1995		15.7	-4.6	-2.6	2.9
1996	-4.2	12.6	-3.3	-1.5	0.9
1997	-4.9	*9.4*	2.0	-2.4	1.0
1998	-4.8	12.3	0.3	-2.7	1.3
1999	-4.3	13.1	-1.2	-2.5	1.3
2000	-3.7	13.0	-0.5	-3.5	1.3
2001	-5.3	14.4	0.6	-4.5	1.3
2002	-7.0	13.5	0.2	-2.4	1.1
2003	-8.0	2.6	0.9	-2.0	0.9

Information on Models	Model 1 (X-12-Arima)	Model 2 (X-12-Arima)	Model 3 (X-12-Arima)	Model 4 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q4.2003 (36)	Q1.1995 - Q4.2003 (36)	Q1.1995 - Q4.2003 (36)	Q1.1995 - Q4.2003 (36)
Model Span (n° of obs.)	Q1.1995 - Q4.2003 (36)	Q1.1995 - Q4.2003 (36)	Q1.1995 - Q4.2003 (36)	Q1.1997 - Q4.2003 (28)
Method	X-12-Arima	X-12-Arima	X-12-Arima	X-12-Arima
PRE-ADJUSTMENT				
Transformation	Logarithm	Logarithm	Logarithm	Logarithm
Mean Correction	Yes	None	Yes	None
Mean t-value	-0.05 [-2.021, 2.021] 5%	-	-0.15 [-2.021, 2.021] 5%	-
Correction for Trading Day Effects	1 Regressor(s)	None	None	None
Trad1 t-value	-2.44 [-2.021, 2.021] 5%	-	--	-
Trad2 t-value	2.44 (derived) [-2.021, 2.021] 5%	-	--	-
Correction for Easter Effect	None	None	None	None
Correction for Outliers	Autom.:AO,LS,TC; 1 Outlier(s) fixed	None	Autom.:AO,LS,TC; 1 Outlier(s) fixed	None
Critical t-value	3.598	Automatic	3.598	Automatic
AO Q2.1997 t-value	-6.81 [-3.598, 3.598] crit.val.	-	-5.61 [-3.598, 3.598] crit.val.	-
Corr. for Missing Obs.	None	None	None	None
Corr. for Other Regr. Effects	None	None	None	None
Specif. of the ARIMA model	(0 1 2)(0 1 1) (fixed)	(0 1 1)(0 1 1) (fixed)	(0 1 0)(0 1 1) (fixed)	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	-0.2266	-0.6008	--	-0.6755
Non-seas. MA (lag 1) t-value	1.52 [-2.021, 2.021] 5%	4.03 [-2.021, 2.021] 5%	--	4.63 [-2.021, 2.021] 5%
Non-seas. MA (lag 2) value	-0.4984	-	--	-
Non-seas. MA (lag 2) t-value	3.36 [-2.021, 2.021] 5%	-	--	-
Seasonal MA (lag 4) value	0.6954	0.2006	0.2833	0.7226
Seasonal MA (lag 4) t-value	-5.15 [-2.021, 2.021] 5%	-1.14 [-2.021, 2.021] 5%	-1.79 [-2.021, 2.021] 5%	-3.21 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood	Exact Maximum Likelihood	Exact Maximum Likelihood
DECOMPOSITION				
X-11 Decomposition	With ARIMA forecasts	With ARIMA forecasts	With ARIMA forecasts	With ARIMA forecasts
X-11 Seasonal Filter	3x3 MA	3x3 MA	3x3 MA	3x3 MA
X-11 Trend Filter	5-term Henderson MA	5-term Henderson MA	5-term Henderson MA	5-term Henderson MA
Seasonality	Significant	Significant	Significant	Significant

Figure 1 Information on Models for CY (1, 2, 3 & 4)



Information on Models	Model 3 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q4.2003 (36)
Model Span (n° of obs.)	Q1.1995 - Q4.2003 (36)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	-0.15 [-2.021, 2.021] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC; 1 Outli...
Critical t-value	3.600
AO Q2.1997 t-value	-5.61 [-3.600, 3.600] crit.val.
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 0)(0 1 1) (fixed)
Seasonal MA (lag 4) value	0.2839
Seasonal MA (lag 4) t-value	-1.80 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood

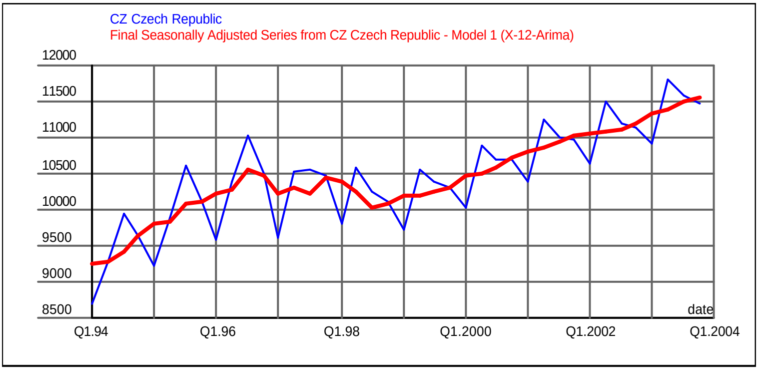
Information on Diagnostics	Model 3 (X-12-Arima)
SA quality index (stand. to...	2.890 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	11.97 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	0.63% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	2.78% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.19 [0, 1] ad-hoc

Figure 2 Final SA Cypriot GDP model 3

4.2. Czech Republic. Czech GDP represented about 15.7 % of NMS GDP in 2002. *Seasonal pattern* – An initial inspection would suggest that the seasonal pattern appears to be quite irregular. Te pattern in all years shows increases Q1-Q2 and decreases Q3-Q4 & Q4-Q1. Q2-Q3 shows decreases for the years 1994,1995, 1999 and 2000 while decreases for the rest. *Amplitude* – The amplitude of the seasonality presents a reduction after the break in the year 1997. *Trend* – The series has a clearly upward trend all along the period. *Outliers* – The series does not seem to have any outliers. An economic explanation would help to identify the phenomena of the Q2-Q3 break in 1997. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present.

The Airline model (0 1 1) (0 1 1) has been automatically selected and the t-values for the coefficients are significant. No outliers have been identified. The results of the seasonal adjustment are good. The final message from Demetra is: “Model passes all diagnostic tests”. No additional investigations appear to be necessary.

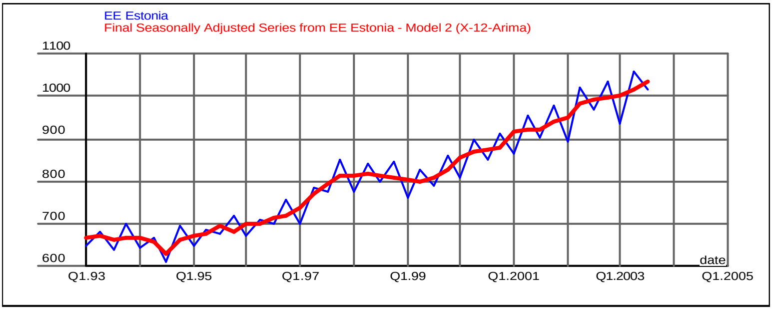


Information on Models	Model 1 (X-12-Arima)
Series Span (n° of obs.)	Q1.1994 - Q4.2003 (40)
Model Span (n° of obs.)	Q1.1994 - Q4.2003 (40)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	-0.25 [-2.021, 2.021] 5%
Correction for Trading Da...	1 Regressor(s)
Trad1 t-value	0.34 [-2.021, 2.021] 5%
Trad2 t-value	-0.34 (derived) [-2.021, 2....
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.619
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	-0.1923
Non-seas. MA (lag 1) t-v...	1.12 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	0.2152
Seasonal MA (lag 4) t-value	-1.26 [-2.021, 2.021] 5%

Information on Diagnostics	Model 1 (X-12-Arima)
SA quality index (stand. to...	2.264 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	9.50 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.53% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.52 [0, 1] ad-hoc

Figure 3 SA Czech GDP model 1 default

4.3.Estonia.Estonian GDP represented 1.4 % of NMS GDP in 2002. *Seasonal pattern*: An initial inspection would suggest that the seasonal pattern appears to be very regular, the pattern in all years shows increases Q1-Q2 and Q3-Q4 while decreases Q2-Q3 and Q4-Q1.*Amplitud:* The amplitude of the seasonality does not have big changes all over the period under consideration. *Trend* – The series has a clearly upward trend all along the period. *Outliers* – The series might have some additive outliers. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run. *Comments on preliminary main results* – According to the Demetra output we note that identifiable seasonality was present. The Airline model has been automatically selected. No outliers have been identified. The results of the seasonal adjustment are good and the final message from Demetra is: "Model passes all diagnostictests".



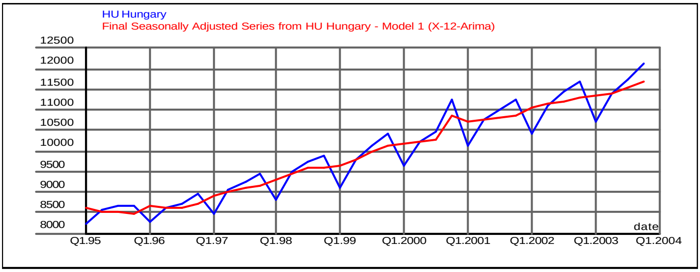
Information on Models	Model 1 (X-12-Arima)
Series Span (n° of obs.)	Q1.1993 - Q3.2003 (43)
Model Span (n° of obs.)	Q1.1993 - Q3.2003 (43)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	0.66 [-2.009, 2.009] 5%
Correction for Trading Da...	1 Regressor(s)
Trad1 t-value	0.33 [-2.009, 2.009] 5%
Trad2 t-value	-0.33 (derived) [-2.009, 2....
Correction for Easter Effect	Yes (6 day(s))
Easter effect t-value	-1.84 [-2.009, 2.009] 5%
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.633
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	0.0185
Non-seas. MA (lag 1) t-v...	-0.12 [-2.009, 2.009] 5%
Seasonal MA (lag 4) value	-0.5103
Seasonal MA (lag 4) t-value	3.56 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 1 (X-12-Arima)
SA quality index (stand. to...	1.541 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	4.66 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	3.07% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.27 [0, 1] ad-hoc

Figure 4 SA Estonian GDP model 1 default

4.4. Hungary. Hungarian GDP represented about 15.8 % of NMS GDP in 2002. *Seasonal pattern* – An initial inspection would suggest that the seasonal pattern appears to be very regular. Te pattern in all years shows increases Q1-Q2, Q2-Q3 and Q3-Q4 while decreases for Q4-Q1. *Amplitude* – The amplitude of the seasonality is quite the same all over the period. *Trend* – The series has a clearly upward trend all along the period. *Outliers* – The series seems to present a clear outlier in Q4 2000. Both additive and transitory change types are feasible. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The Airline model (0 1 1) (0 1 1) has been automatically selected and the t-values for the coefficients are significant. Q4 2000 has been identified as “transitory change” The results of the seasonal adjustment are good. The final message from Demetra is: “Model passes all diagnostic tests”. No additional investigations appear to be necessary.



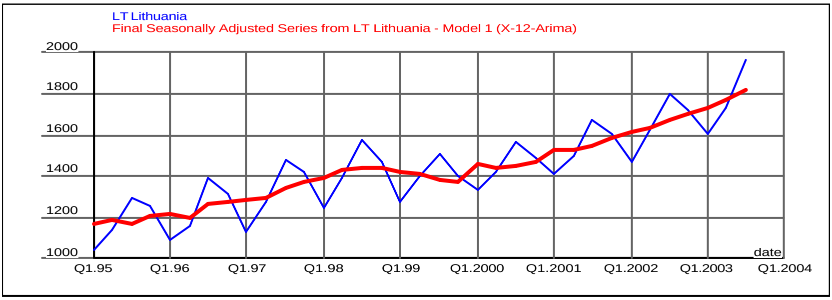
Information on Models	Model 1 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q4.2003 (36)
Model Span (n° of obs.)	Q1.1995 - Q4.2003 (36)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	0.57 [-2.021, 2.021] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC; 1 Outli...
Critical t-value	3.598
TC Q4.2000 t-value	8.38 [-3.598, 3.598] crit.val.
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	0.1032
Non-seas. MA (lag 1) t-v...	-0.56 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	-0.0591
Seasonal MA (lag 4) t-value	0.35 [-2.021, 2.021] 5%

Information on Diagnostics	Model 1 (X-12-Arima)
SA quality index (stand. to...	2.481 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	5.71 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.29% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	2.78% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.18 [0, 1] ad-hoc

Figure 5 SA Hungarian GDP model 1 default

4.5. Lithuania. Lithuanian GDP represented about 2.34% of NMS GDP in 2002. *Seasonal pattern*: An initial inspection would suggest that the seasonal pattern appears regular with no big changes – the pattern in all years shows increases Q1-Q2 & Q2-Q3, and decreases Q3-Q4 & Q4-Q1. *Amplitude*: The amplitude of the seasonality is reduced from Q1 1999 to the end. *Trend*: The trend is clearly increasing all along the series. *Outliers*: The series does not seem to have any type of outliers. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The Airline model (0 1 1) (0 1 1) has been automatically selected and the t-values for the coefficients are significant. No outliers have been identified. The final message from Demetra is: “Model passes all diagnostic tests”. No additional investigations appear to be necessary.



Information on Models	Model 1 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q3.2003 (35)
Model Span (n° of obs.)	Q1.1995 - Q3.2003 (35)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	0.41 [-2.021, 2.021] 5%
Correction for Trading Da...	None
Correction for Easter Effect	Yes (6 day(s))
Easter effect t-value	-2.51 [-2.021, 2.021] 5%
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.593
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	-0.2190
Non-seas. MA (lag 1) t-v...	1.21 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	-0.1564
Seasonal MA (lag 4) t-value	0.91 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 1 (X-12-Arima)
SA quality index (stand. to...	1.982 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	15.18 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	0.53% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.30 [0, 1] ad-hoc

Figure 6 SA Lithuanian GDP model 1 default

4.6. Latvia. Latvian GDP represented about 1.08% of NMS GDP in 2002. *Seasonal pattern* – An initial inspection would suggest that the seasonal pattern does not appear regular. 1992 does not have a seasonal pattern at all as it consist of a dramatic fall in GDP. From 1990 to 1996 (except 1992), the seasonal patterns look similar, but from 1997 there seems to be a change of seasonality. *Amplitude* – The first two years have much bigger amplitudes the other years and are at much high level. 1992 shows a completely different behaviour in comparison with all the other years, which is likely to cause some inconsistencies in the seasonal adjustment. From 1993, there is no change in the amplitudes even if the trend started an upward in 1996.

Trend – Latvian GDP falls sharply from 1990 to 1992, then is fairly flat from 1993 to 1996 (at a level of 600) before starting on an upward trend from the beginning of 1997. *Outliers* – Due to the different behaviour of the first three years, some outliers might be detected. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run. Given the big change occurred in 1992, in this exercise we apply the seasonal filter only to the period 1993-2003.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The Airline model (0 1 1) (0 1 1) has been automatically selected and the t-values for the coefficients are significant. No outliers have been identified. The final message from Demetra is: “Model passes all diagnostic tests”. In order to verify our above consideration on the changes in the seasonality we turn to the M statistics. The message is quite clear: M8, M10 and M11 fail.

3 Monitoring and Quality Assessment M Statistics F 3. (Model 1 for LV)

All the measures below are in the range from 0 to 3 with an acceptance region from 0 to 1.

8. The size of the fluctuations in the seasonal component throughout the whole series. M8 = 1.724

9. The average linear movement in the seasonal component throughout the whole series. M9 = 0.721

10. Same as 8, calculated for recent years only. M10 = 1.311

11. Same as 9, calculated for recent years only. M11 = 1.164

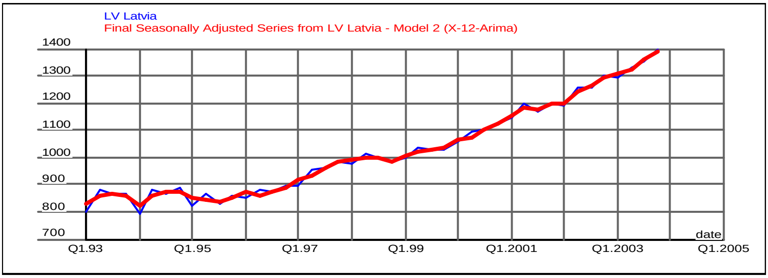
*** ACCEPTED *** at the level 0.51

*** Check the 3 above measures which failed.

*** Q (without M2) = 0.58 ACCEPTED.

To resolve this moving seasonality, we need to use a shorter moving average filter. Demetra automatically used 3x3. Let us re-run the SA with the Airline parameters and 3x1 filter. Some consideration on the three options to support the adoption of model 2:

- o M8, M10 and M11 have improved
- o there are no relevant changes within the other statistics



Information on Models	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1993 - Q4.2003 (44)
Model Span (n° of obs.)	Q1.1993 - Q4.2003 (44)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	None
Mean Correction	Yes
Mean t-value	1.05 [-2.009, 2.009] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.630
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	-0.0414
Non-seas. MA (lag 1) t-v...	0.25 [-2.009, 2.009] 5%
Seasonal MA (lag 4) value	-0.2335
Seasonal MA (lag 4) t-value	1.45 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 2 (X-12-Arima)
SA quality index (stand. to...	2.437 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	8.67 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	2.33% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.56 [0, 1] ad-hoc

Figure 7 SA Latvian GDP model 2

Information on Models	Model 1 (X-12-Arima)	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1993 - Q4.2003 (44)	Q1.1993 - Q4.2003 (44)
Model Span (n° of obs.)	Q1.1993 - Q3.2003 (43)	Q1.1993 - Q4.2003 (44)
Method	X-12-Arima	X-12-Arima
PRE-ADJUSTMENT		
Transformation	None	None
Mean Correction	Yes	Yes
Mean t-value	0.87 [-2.009, 2.009] 5%	1.05 [-2.009, 2.009] 5%
Correction for Trading Day Effects	None	None
Correction for Easter Effect	Yes (6 day(s))	None
Easter effect t-value	-2.05 [-2.009, 2.009] 5%	–
Correction for Outliers	Autom.:AO,LS,TC	Autom.:AO,LS,TC
Critical t-value	3.633	3.637
Corr. for Missing Obs.	None	None
Corr. for Other Regr. Effects	None	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	0.0134	-0.0412
Non-seas. MA (lag 1) t-value	-0.08 [-2.009, 2.009] 5%	0.25 [-2.009, 2.009] 5%
Seasonal MA (lag 4) value	-0.1449	-0.2332
Seasonal MA (lag 4) t-value	0.87 [-2.009, 2.009] 5%	1.45 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood

Figure -7 Information on Models for LV (1 & 2)

4.7. Malta. Maltese GDP represented 1.1% of NMS GDP in 2002. *Seasonal pattern* – An initial inspection would suggest that the seasonal pattern does not appear very regular. The pattern shows in all the year increases Q1-Q2 and Q2-Q3 (except for 1998) and decreases Q4-Q1. Q3-Q4 alternates increases with decreases.

Amplitude – The first three years have much bigger amplitudes the other years. 1998 and 1999 show a clear reduction in the amplitude that return to be stable starting from 2000. *Trend* – Maltese GDP presents an upward trend from 1995 to 2000 when starts a flat tendency. *Outliers* – Due to the different behaviour of the series in Q3-Q4 plus the break for Q2-Q3 in 1998 a transitory change could be identified at the end of 1997.

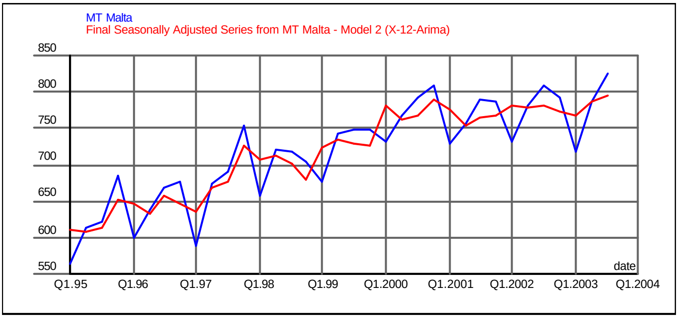
After having made an initial graphical appreciation of the series and the seasonal behaviour, X-12 ARIMA is run with the default options (automated module with annual correction).

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. Demetra automatically selected the ARIMA model (2 1 0) (0 1 1). No outliers have been identified. Two additional models are tested. Some considerations to support the adoption of model 2: a) Airline has t-statistics associated to MA(lag 1) and MA (lag 4) not significant, b)

Model 2 performs at least as well as Model 1 and has a lower order in the ARIMA

Information on Models	Model 1 (X-12-Arima)	Model 2 (X-12-Arima)	Model 3 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q3.2003 (35)	Q1.1995 - Q3.2003 (35)	Q1.1995 - Q3.2003 (35)
Model Span (n° of obs.)	Q1.1995 - Q3.2003 (35)	Q1.1995 - Q3.2003 (35)	Q1.1995 - Q3.2003 (35)
Method	X-12-Arima	X-12-Arima	X-12-Arima
PRE-ADJUSTMENT			
Transformation	Logarithm	Logarithm	Logarithm
Mean Correction	Yes	Yes	Yes
Mean t-value	-0.80 [-2.021, 2.021] 5%	-0.28 [-2.021, 2.021] 5%	-4.16 [-2.021, 2.021] 5%
Correction for Trading Day Effects	None	None	None
Correction for Easter Effect	None	None	None
Correction for Outliers	Autom.:AO,LS,TC	Autom.:AO,LS,TC	Autom.:AO,LS,TC
Critical t-value	3.593	3.600	3.593
Corr. for Missing Obs.	None	None	None
Corr. for Other Regr. Effects	None	None	None
Specif. of the ARIMA model	(2 1 0)(0 1 1) (fixed)	(2 1 0)(0 1 0) (fixed)	(0 1 1)(0 1 1) (fixed)
Non-seas. AR (lag 1) value	0.4459	0.2939	–
Non-seas. AR (lag 1) t-value	-2.60 [-2.021, 2.021] 5%	-1.63 [-2.021, 2.021] 5%	–
Non-seas. AR (lag 2) value	0.2426	0.1586	–
Non-seas. AR (lag 2) t-value	-1.40 [-2.021, 2.021] 5%	-0.87 [-2.021, 2.021] 5%	–
Non-seas. MA (lag 1) value	--	–	-0.9998
Non-seas. MA (lag 1) t-value	--	–	8.32 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	-0.6753	–	-0.7779
Seasonal MA (lag 4) t-value	4.96 [-2.021, 2.021] 5%	–	6.03 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood	Exact Maximum Likelihood

Figure -8 Information on Models for MT (1, 2 & 3)



Information on Models	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1995 - Q3.2003 (35)
Model Span (n° of obs.)	Q1.1995 - Q3.2003 (35)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	-0.28 [-2.021, 2.021] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.600
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(2 1 0)(0 1 0) (fixed)
Non-seas. AR (lag 1) value	0.2938
Non-seas. AR (lag 1) t-value	-1.63 [-2.021, 2.021] 5%
Non-seas. AR (lag 2) value	0.1586
Non-seas. AR (lag 2) t-value	-0.87 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood

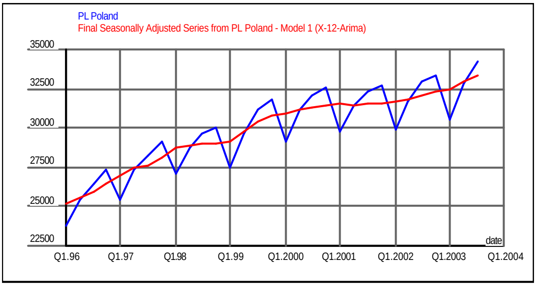
Information on Diagnostics	Model 2 (X-12-Arima)
SA quality index (stand. to...	2.426 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	12.06 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.70% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.49 [0, 1] ad-hoc

Figure -9 Final SA Maltese GDP model 2

4.7. Poland. Polish GDP represents about 45% of NMS GDP. Given the relative weight, this data should result very informative for the basic indicators of the shortcoming EU25 GDP SA series. *Seasonal pattern*: An initial inspection would suggest that the seasonal pattern appears regular with no change, the pattern in all years shows increases Q1-Q2, Q2-Q3, Q3-Q4 and decreases Q4-Q1.

Amplitude: The amplitude of the seasonality does not have big changes all over the period under analysis. *Trend*: The trend is clearly increasing all along the series. *Outliers*: The series does not seem to have any type of outliers. After having made an initial graphical appreciation of the series and the seasonal behaviour, X-12 ARIMA is run with the default options (automated module) as indicated above. Below the results.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The Airline model (0 1 1) (0 1 1) has been automatically selected. No outliers were identified. The results of the seasonal adjustment are good the final message from Demetra is: “Model passes all diagnostic tests”.



Information on Models	Model 1 (X-12-Arima)
Series Span (n° of obs.)	Q1.1996 - Q3.2003 (31)
Model Span (n° of obs.)	Q1.1996 - Q3.2003 (31)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	-1.55 [-2.021, 2.021] 5%
Correction for Trading Da...	1 Regressor(s)
Trad1 t-value	0.09 [-2.021, 2.021] 5%
Trad2 t-value	-0.09 (derived) [-2.021, 2....
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.600
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	0.4815
Non-seas. MA (lag 1) t-v...	-2.90 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	-0.7174
Seasonal MA (lag 4) t-value	4.57 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 1 (X-12-Arima)
SA quality index (stand. to...	1.069 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	7.69 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.01% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.13 [0, 1] ad-hoc

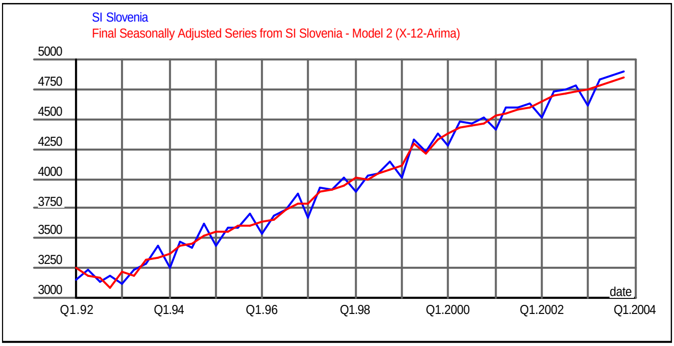
Figure -10 SA Polish GDP model 1 default

4.9 Slovenia. Slovenian GDP represented about 6.7% of NMS GDP in 2002. *Seasonal pattern* – The pattern in all years shows increases Q1-Q2, Q3-Q4 and a decrease Q4-Q1. Q2-Q3 shows decreases from 1992 to n1998 (except 1993) and increases from 1998 until the end (except 1999). *Amplitude* – The amplitude of the seasonality does not have big changes all over the period under analysis. *Trend* – The trend is clearly increasing all along the period. *Outliers* – As seen in the seasonal pattern, the series presents two breaks. The one in 1993 is probably a "level shift" or "transitory change". The one in 1999 is more likely to be an additive. An economic explanation could help to identify the more appropriate type. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The

Airline model has been automatically selected. Q1 1992 has been identified as transitory change outlier. The results of the seasonal adjustment are good, none of the M statistics fail and the final message from Demetra is: "Model passes all diagnostic tests". Some critics to the default results:

a) the series could be over-differenced or have too many coefficients. The t-value of the coefficient of MA (lag 4) and MA (lag 1) are out of the range,
b) in spite of our consideration on Q3 1993 and Q2 1999, Q1 1992 has been identified as outlier. It is best to focus initially on improving the ARIMA model. X-12 has five pre-selected ARIMA models, from which it selects the best. Let' try to find a better one using TRAMO-SEATS. So, the raw data is run through TRAMO-SEATS (model 2) and the ARIMA selected was (1 1 0)(0 1 0), which is not one of the pre-defined model of X-12. Q3 1993 and Q2 1999 are respectively identified as "level shift" and additive outliers. When this ARIMA is used with X-12 (model 3) as a user-defined option, where we set Q3 1993 as LS and Q2 1999 as additive outliers, none of the M statistics fail. In other words, the results of the improved adjustment are: a) the new lower order ARIMA model is (1 1 0)(0 1 0); b)the identified outliers are coherent with our preliminary consideration,
c) all the M statistics are in the range.For our SA policy we adopt model 3. Below the Information on Models from the three options.



Information on Models	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1992 - Q4.2003 (48)
Model Span (n° of obs.)	Q1.1992 - Q4.2003 (48)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	None
Mean Correction	Yes
Mean t-value	0.65 [-2.009, 2.009] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC; 2 Outli...
Critical t-value	3.700
LS Q3.1993 t-value	3.98 [-3.655, 3.655] crit.val.
AO Q2.1999 t-value	3.96 [-3.700, 3.700] crit.val.
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(1 1 0)(0 1 0) (fixed)
Non-seas. AR (lag 1) value	0.4247
Non-seas. AR (lag 1) t-value	-3.10 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 2 (X-12-Arima)
SA quality index (stand. to...	4.686 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	17.90 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.31% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	4.17% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.41 [0, 1] ad-hoc

Figure -11 Final SA Slovenian GDP model 3

Information on Models	Model 1 (X-12-Arima)	Model 2 (Tramo-Seats)	Model 3 (X-12-Arima)
Series Span (n° of obs.)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)
Model Span (n° of obs.)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)
Method	X-12-Arima	Tramo/Seats	X-12-Arima
PRE-ADJUSTMENT			
Transformation	None	None	None
Mean Correction	Yes	None	Yes
Mean t-value	-0.79 [-2.009, 2.009] 5%	--	0.65 [-2.009, 2.009] 5%
Correction for Trading Day Effects	None	None	None
Correction for Easter Effect	None	Yes (6 day(s))	None
Easter effect t-value	–	-3.60 [-2.021, 2.021] 5%	--
Correction for Outliers	Autom.:AO,LS,TC; 1 Outlier(s) fixed	Autom.:AO,LS,TC; 2 Outlier(s) fixed	Autom.:AO,LS,TC; 2 Outlier(s) fixed
Critical t-value	3.655	3.000	3.700
TC Q1.1992 t-value	4.66 [-3.655, 3.655] crit.val.	--	--
LS Q3.1993 t-value	–	3.91 [-3.000, 3.000] crit.val.	3.98 [-3.655, 3.655] crit.val.
AO Q2.1999 t-value	–	3.82 [-3.000, 3.000] crit.val.	3.96 [-3.700, 3.700] crit.val.
Corr. for Missing Obs.	None	None	None
Corr. for Other Regr. Effects	None	None	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)	(1 1 0)(0 1 0) (fixed)	(1 1 0)(0 1 0) (fixed)
Non-seas. AR (lag 1) value	–	0.2777	0.4247
Non-seas. AR (lag 1) t-value	–	1.90 [-2.021, 2.021] 5%	-3.10 [-2.009, 2.009] 5%
Non-seas. MA (lag 1) value	-0.6308	--	--
Non-seas. MA (lag 1) t-value	5.35 [-2.009, 2.009] 5%	--	--
Seasonal MA (lag 4) value	-0.7343	--	--
Seasonal MA (lag 4) t-value	5.65 [-2.009, 2.009] 5%	--	--
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood	Exact Maximum Likelihood

Figure -12 Information on Models for SI (1, 2 & 3)

1.1 Slovak Republic

4.10. Slovak Republic. Slovak GDP represented about 6.7% of NMS GDP in 2002. *Seasonal pattern* – An initial inspection would suggest that the seasonal pattern appears to be very regular – the pattern in all years shows increases Q1-Q2, Q2-Q3 and decreases Q3-Q4 and Q4-Q1. *Amplitude* – The amplitude of the seasonality increases until 1998 and is quite constant after that. *Trend* – The series presents a clearly upward trend. *Outliers* – The series does not seem to have any additive outliers. Still, at the end of 1998 it seems to change the intercept of the trend that moves slightly down in parallel. A level shift might be identified. After having made an initial graphical appreciation of the series, default X-12 ARIMA is run.

Comments on preliminary main results – According to the Demetra output we note that identifiable seasonality was present. The Airline model has been automatically selected. Q4 1998 has been identified as level shift. The results of the seasonal adjustment are good and the final message from Demetra is: “Model passes all diagnostic tests”. Some critics to the default results: the series could be over-differenced. The t-value of the coefficient MA (lag 1) is out of the range.

Let us do some additional investigation within the corresponding log file. In the table E5 (quarter-to-quarter percent change in the original series), the percent change of Q4 1998 is far away compared to the rest of the percentages of the same quarter. This confirms the hypothesis of a level shift and not a transitory change outlier because the percent change for the Q1 1999 is very similar compared to the other percent changes of the same quarter until the end of the period.

Table -4 Quarter-to-quarter percent change in the original Slovak series E 5

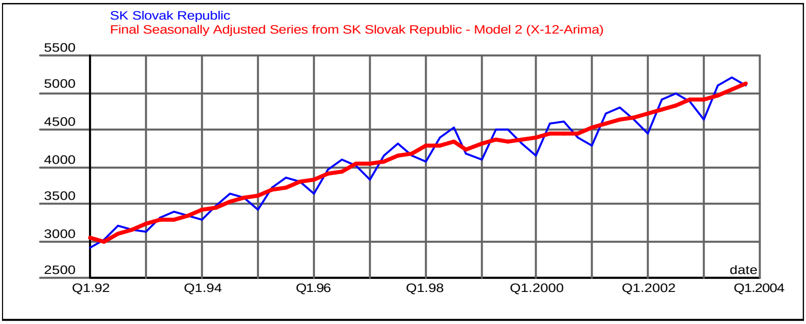
E 5 Quarter-to-quarter percent change in the original series From 1992.2 to 2003.4 Observations 47

	1st	2nd	3rd	4th	AVGE
1992		3.1	6.1	-1.6	2.5
1993	-0.8	6.0	2.4	-1.3	1.6
1994	-1.8	6.0	4.4	-1.5	1.8
1995	-4.1	8.6	3.2	-1.5	1.5
1996	-3.8	8.6	3.2	-1.5	1.6
1997	-4.9	8.6	3.7	-3.7	0.9
1998	-2.2	7.9	3.1	**-7.4**	0.3
1999	-2.2	9.8	0.4	-4.4	0.9
2000	-3.6	10.3	0.8	-4.7	0.7
2001	-2.5	9.9	1.6	-3.5	1.4
2002	-3.6	10.0	1.9	-2.5	1.5
2003	-4.7	9.7	2.3	-2.0	1.3

Turning to focus on improving the ARIMA model, let us test the lower order model (0 1 0) (0 1 1). Some considerations to support the adoption of model 2: 1) Airline has t-statistics associated to MA(lag 1) out of range. 2)Model 2 performs at least as well as Model 1 and has a lower order in the ARIMA

Information on Models	Model 1 (X-12-Arima)	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)
Model Span (n° of obs.)	Q1.1992 - Q4.2003 (48)	Q1.1992 - Q4.2003 (48)
Method	X-12-Arima	X-12-Arima
PRE-ADJUSTMENT		
Transformation	Logarithm	None
Mean Correction	Yes	Yes
Mean t-value	-1.04 [-2.009, 2.009] 5%	0.11 [-2.009, 2.009] 5%
Correction for Trading Day Effects	None	None
Correction for Easter Effect	None	None
Correction for Outliers	Autom.:AO,LS,TC; 1 Outlier(s) fixed	Autom.:AO,LS,TC; 1 Outlier(s) fixed
Critical t-value	3.700	3.655
LS Q4.1998 t-value	-4.41 [-3.655, 3.655] crit.val.	-4.22 [-3.655, 3.655] crit.val.
Corr. for Missing Obs.	None	None
Corr. for Other Regr. Effects	None	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)	(0 1 0)(0 1 1) (fixed)
Non-seas. MA (lag 1) value	-0.6287	–
Non-seas. MA (lag 1) t-value	5.11 [-2.009, 2.009] 5%	–
Seasonal MA (lag 4) value	-0.0291	-0.0396
Seasonal MA (lag 4) t-value	0.21 [-2.009, 2.009] 5%	0.28 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood

Figure -13 Information on Models for SK (1 & 2)



Information on Models	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1992 - Q4.2003 (48)
Model Span (n° of obs.)	Q1.1992 - Q4.2003 (48)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	None
Mean Correction	Yes
Mean t-value	0.11 [-2.009, 2.009] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC; 1 Outli...
Critical t-value	3.650
LS Q4.1998 t-value	-4.22 [-3.650, 3.650] crit.val.
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 0)(0 1 1) (fixed)
Seasonal MA (lag 4) value	-0.0397
Seasonal MA (lag 4) t-value	0.28 [-2.009, 2.009] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 2 (X-12-Arima)
SA quality index (stand. to...	3.149 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	12.26 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	1.04% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	2.08% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.40 [0, 1] ad-hoc

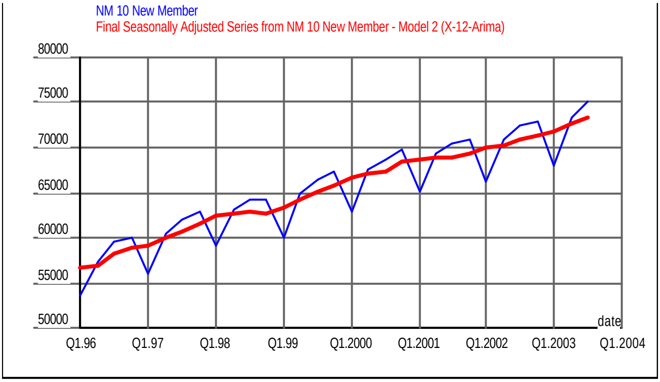
Figure -14 Final SA Slovak GDP model 2

4.11. NMS aggregate. NMS aggregate raw GDP is the sum of the ten raw GDPs of the New Member states. The corresponding SA GDP for NMS can be obtained in two ways: 1) run the seasonal adjustment on the raw series via Demetra (direct approach), 2) sum up the seasonally adjusted GDPs of the ten NMS (indirect approach). We now run the direct approach and then we compare the results with the figures obtained by the indirect approach. *Seasonal pattern* – The pattern in all years shows increases Q1-Q2, Q2-Q3 and Q3-Q4 and decreases Q4-Q1. *Amplitude* – The amplitude of the seasonality does not have big changes. *Trend* – The trend is clearly increasing all along the period. *Outliers* – No outliers seems to be present. After having made an initial graphical appreciation of the series and the seasonal behaviour, X-12 ARIMA is run with the default options (automated module with annual correction). *Comments on preliminary main results* – According to the Demetra output we note

that identifiable seasonality was present. The Airline model has been automatically selected. No outliers have been identified. The results of the seasonal adjustment are good, none of the M statistics fail and the final message from Demetra is: "Model passes all diagnostic tests". Some critics to the default results: the series is surely over-differenced or have too many coefficients. The coefficient of MA (lag 4) is near to minus one and its t-value is out of the range.
Turning to focus on improving the ARIMA model, Let us test the lower order model (0 1 1) (0 1 0). Some considerations to support the adoption of model 2: 1) M Statistics are good for both models. 2)Model 1 has t-statistics associated to MA(lag 4) out of range. 3) Model 2 has a lower order

Information on Models	Model 1 (X-12-Arima)	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1996 - Q3.2003 (31)	Q1.1996 - Q3.2003 (31)
Model Span (n° of obs.)	Q1.1996 - Q3.2003 (31)	Q1.1996 - Q3.2003 (31)
Method	X-12-Arima	X-12-Arima
PRE-ADJUSTMENT		
Transformation	Logarithm	Logarithm
Mean Correction	Yes	Yes
Mean t-value	-1.09 [-2.021, 2.021] 5%	-0.04 [-2.021, 2.021] 5%
Correction for Trading Day Effects	None	None
Correction for Easter Effect	None	None
Correction for Outliers	Autom.:AO,LS,TC	Autom.:AO,LS,TC
Critical t-value	3.600	3.570
Corr. for Missing Obs.	None	None
Corr. for Other Regr. Effects	None	None
Specif. of the ARIMA model	(0 1 1)(0 1 1) (fixed)	(0 1 1)(0 1 0) (fixed)
Non-seas. MA (lag 1) value	0.1331	0.2533
Non-seas. MA (lag 1) t-value	-0.84 [-2.021, 2.021] 5%	-1.46 [-2.021, 2.021] 5%
Seasonal MA (lag 4) value	-0.9999	–
Seasonal MA (lag 4) t-value	4.84 [-2.021, 2.021] 5%	–
Method of Estimation	Exact Maximum Likelihood	Exact Maximum Likelihood
DECOMPOSITION		
X-11 Decomposition	With ARIMA forecasts	With ARIMA forecasts
X-11 Seasonal Filter	3x9 MA	3x9 MA
X-11 Trend Filter	5-term Henderson MA	5-term Henderson MA
Seasonality	Significant	Significant

Figure -15 Information on Models for NMS (1 & 2)



Information on Models	Model 2 (X-12-Arima)
Series Span (n° of obs.)	Q1.1996 - Q3.2003 (31)
Model Span (n° of obs.)	Q1.1996 - Q3.2003 (31)
Method	X-12-Arima
PRE-ADJUSTMENT	
Transformation	Logarithm
Mean Correction	Yes
Mean t-value	-0.04 [-2.021, 2.021] 5%
Correction for Trading Da...	None
Correction for Easter Effect	None
Correction for Outliers	Autom.:AO,LS,TC
Critical t-value	3.570
Corr. for Missing Obs.	None
Corr. for Other Regr. Effects	None
Specif. of the ARIMA model	(0 1 1)(0 1 0) (fixed)
Non-seas. MA (lag 1) value	0.2535
Non-seas. MA (lag 1) t-v...	-1.46 [-2.021, 2.021] 5%
Method of Estimation	Exact Maximum Likelihood

Information on Diagnostics	Model 2 (X-12-Arima)
SA quality index (stand. to...	1.079 [0, 10] ad-hoc
STATISTICS ON RESIDU...	
Ljung-Box on residuals	11.00 [0, 32.90] 0.1%
Ljung-Box on squared res...	-- [0, ?] 0.1%
DESCRIPTION OF RESI...	
Kurtosis	-- [?, ?] 0.1%
FORECAST ERROR	
Forecast error over last year	0.40% [0%, 15.0%] ad-hoc
OUTLIERS	
Percentage of outliers	0.00% [0%, 5.0%] ad-hoc
CRITERIA FOR DECOM...	
Combined statistic Q (M1,...	0.07 [0, 1] ad-hoc

Figure 16 Final SA NMS GDP model 2

Below comparison NMs GDP directly vs. indirectly seasonally adjusted where differences are not very high.

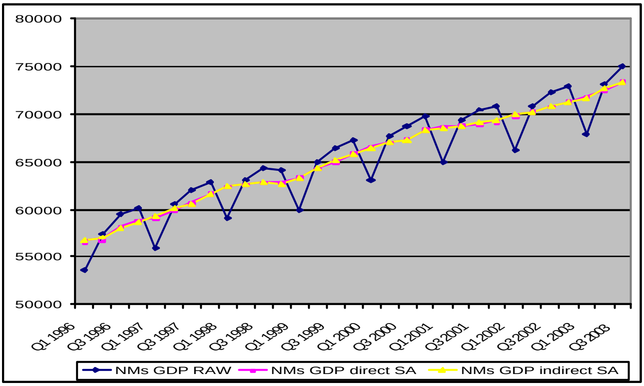


Figure 17 Direct Vs. Indirect approach for NMS SA GDP

5. Cycles in the NMS

There is an obvious and intense interest within Europe as to the nature of the links between growth in the countries of the European Union (EU). Such growth is often referred to in terms of so-called business cycle movements, and a key issue is the extent to which monetary integration may imply a single, common, business cycle across the countries of the EU, so that their short-run and medium-run growth experiences will be inextricably linked. If there is to be (ultimately) such a common business cycle, it should be anticipated that the affiliations across European countries will have become progressively stronger over time. Business cycles constitute one of the components – perhaps the most important – in which the economic time series are traditionally decomposed. They show the fluctuations (ups and downs, expansions and contractions) around the long-term growth of the series, called the trend component. As such, business cycles are unobservable in nature, but can be extracted – or estimated – using statistical sophisticated techniques.

The identification of the Business Cycle is then a major issue for the short-term economic analyst. On one hand, the economist can easily comment, from this cycle estimate, on the current evolution of the economy and on the other hand he can use it to define some leading indicators. Nevertheless, to estimate the Business Cycle, the analyst has to face two main problems. The first one is the multiplicity of economic indicators depicting the many faces of the economic activity: Industrial Production Index, Business Climate, GDP etc. The second one is the various methods to extract the so-called “cycle” from an economic indicator. The most common statistical tools to extract the cycle are the Baxter-King filter and the Hodrick-Prescott filter. In this paper we extract the so called “cycles” from the GDPs. As statistical tool to extract the cycle we will use the Hodrick-Prescott filter facility available in Demetra. The Hodrick Prescott filter (HP) assumes that an observed time series t y is the sum of a cyclical component and a growth component. The deviations with respect to the growth component are, on average, zero for long periods of time. A measure of smoothness for the trend component is the sum of the squares of its second differences. The HP filter chooses the growth component to minimise the following loss function:

$$\underset{t}{Min}\sum_{t=1}^{T}(y_t - t_t)^2 + l\sum_{t=2}^{T-1}[(t_{t+1} - t_t)(t_t - t_{t-1})]^2$$

where l is the smoothness parameter. When l=0, the growth component is simply the series and when l approaches infinity, the growth component approaches a linear trend. The default values are usually l=1600 for a quarterly series and l=14400 for a monthly series. For the NMS aggregate, as computed from New Member States data, the cycle is derived in two ways: 1) from the aggregation of the national cycles (the so-called indirect approach), 2) from the European aggregate (direct approach)

Table 5.1. below show the correlation index between the national cycles and the NMS indirect cycle. We can clearly see some clusters: (PL, NMS)-(EE, LT,LV, SI and SK)-(CY,CZ,LV,SL).

Table 5 Correlation between national cycle and NMS indirect cycle

CY	CZ	EE	HU	LT	LV	MT	PL	SK	SL
0,00	-0,06	0,28	0,39	0,00	0,45	0,58	0,92	0,57	-0,05

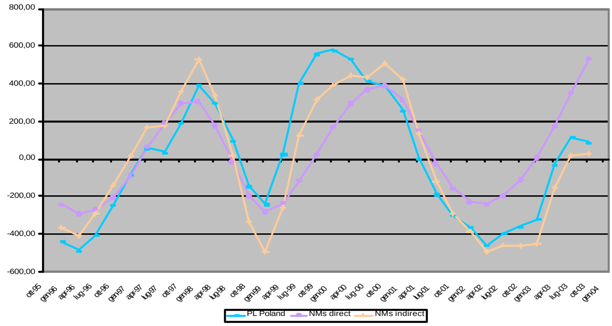


Figure 18 PL plus direct vs. indirect cycle for NMS aggregate.

We see in figures above that NMS direct and indirect present common turning point. With respect to the NMS indirect cycle Pl present a one year period lag.

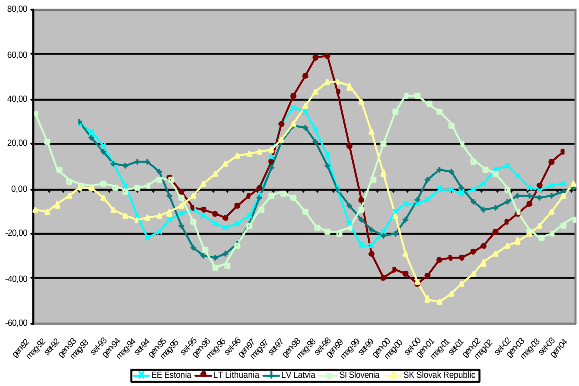


Figure 19 EE, LT,LV, SI and SK cycles

We see in figures above that Balkan Countries present common behaviour of SI and SK with some lags. In figures below is clear that CY and MT have common trend, while CZ HU are quite apart from all the rest.

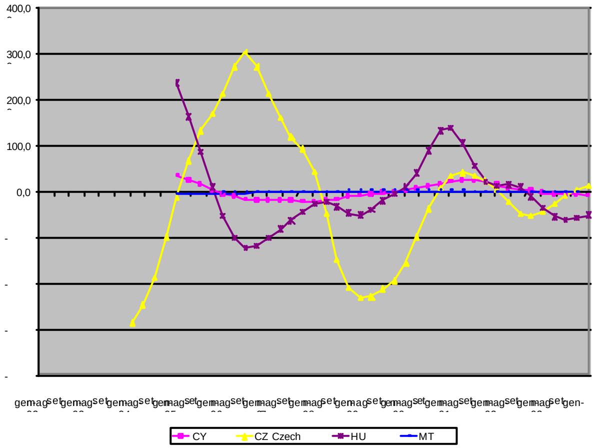


Figure 20 CY, CZ, HU and MT cycle

6. Main conclusions.

Considering the length of the time series, and the fact that the analysis has been performed without involving the expert from the countries, the resulting adjustments are actually rather good. But, we feel confident that they could be improved yet further. Within the analysed series, some countries requested additional investigation to the default procedure via the detailed mode. Once the more appropriate model has been identified, it is strongly advisable to keep it fix for a certain period. In Demetra this is possible by re-running the previously saved options within the automated mode. As soon as additional and/or significant information becomes available a revision of the parameters should be taken in consideration. As general note, from table below we can see that the Airline model has been used in half of the case studies.

Table 6 ARIMA models and outliers of NMS and CCs GDPs

	Weight on CCs GDP in 2002	Weight on NMS GDP in 2002	ARIMA models		Outliers		
			Airline	Others	Additive	Transitory change	Level Shift
CY	1,8%	3,1%		(0 1 0) (0 1 1)	Q2 1997	no	no
CZ	9,3%	15,7%	(0 1 1) (0 1 1)		no	no	no
EE	0,8%	1,4%	(0 1 1) (0 1 1)		no	no	no
HU	9,3%	15,8%	(0 1 1) (0 1 1)		no	Q4 2000	no
LV	1,4%	2,3%	(0 1 1) (0 1 1)		no	no	no
LT	1,0%	1,8%	(0 1 1) (0 1 1)		no	no	no
MT	0,7%	1,1%		(2 1 0) (0 1 0)	no	no	no
PL	26,7%	45,3%	(0 1 1) (0 1 1)		no	no	no
SK	3,9%	6,7%		(1 1 0) (0 1 0)	Q2 1999	no	Q3 1993
SL	4,0%	6,8%		(0 1 0) (0 1 1)	no	no	Q4 1998
NMS		100%		(0 1 1) (0 1 0)	no	no	no

In order to optimize any seasonal adjustment, it is important to pre-adjust the series to take account of external effects that could have one-off effects on the time series. This is best done by using prior knowledge of the political and economic circumstances to explain outlying data points and breaks in trend, seasonal pattern, etc. So, the adjustments could probably be improved by the input of such background information.

Regarding the seasonally adjusted NMS aggregate it has been showed that when comparing figures obtained by direct vs. indirect approach, differences in values are very small. It must be noted that when using the direct approach the information on the outliers is not used. When aggregating raw series the relevance of the outliers might be lost because of the low weight of the country on the aggregate total. It is showed in table above that even if some outliers are present at country level, no outliers are visible in the NMS aggregate. To avoid this lost, the indirect approach appear to be preferable to produce seasonally adjusted figures.

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